

**MISSOURI DEPARTMENT OF NATURAL RESOURCES**  
**DIVISION OF ENVIRONMENTAL QUALITY**  
**ENVIRONMENTAL SERVICES PROGRAM**  
**Standard Operating Procedures**

SOP #: MDNR-FSS-205 EFFECTIVE DATE: 01/08/2001

SOP TITLE: Field Operation of Metal Detector (Fisher M Scope Model TW5)

WRITTEN BY: Larry Alderson, Chief, Superfund/RCRA Unit, Field Services Section, ESP

APPROVED BY: James H. Long, Director, Environmental Services Program

SUMMARY OF REVISIONS: Format changes were made to conform to new SOP procedures.


APPLICABILITY: Applies to the use of the Fisher M Scope Model TW5 in the field by  
Field Services and EER Sections of the Environmental Services  
Program


DISTRIBUTION: Supervisors, FSS and EERS, ESP  
SOP Coordinator  
MDNR Intranet


RECERTIFICATION RECORD:

Date Reviewed				
Initials				

## 1.0 SCOPE AND APPLICABILITY

The Fisher M Scope Model TW5 Metal Detector can be used by field staff in locating buried drums, tanks, pipe, cable, and other large metal objects that may be of interest during an investigation or emergency response. This SOP provides directions for operating the instrument and some of the applications in which it may be used by ESP field staff.

## 2.0 SUMMARY OF METHOD

The Fisher M Scope Model TW5 Metal Detector is capable of detecting all types of metal by producing an electromagnetic current using a radio frequency transmitter and receiver, and can be used both in an inductive or conductive mode. This method will discuss the use of the instrument and some of the limitations and types of interference that may effect its operation.

## 3.0 DEFINITIONS AND ACRONYMS

- HASP - Health and Safety Plan
- HAZWOPER - Hazardous Waste Operations and Emergency Response
- PPE - Personal Protective Equipment
- Safety Officer - The person, generally the ESP sampler, who is assigned or assumes the duties of the health and safety officer for a specific investigation.

## 4.0 INTERFERENCES

Interference that may cause erroneous signals include soils with high moisture or iron content, nearby metal objects such as vehicles or steel toed boots, and to a limited extent, overhead power lines. The sensitivity adjustment can, however, be used to help override problems caused by power lines and high moisture or iron rich soils. The investigator should also keep in mind that lots or other areas covered by concrete will most likely contain metal reinforcement bars that will interfere with any potential readings.

## 5.0 PERSONNEL QUALIFICATIONS

5.1 All ESP personnel directly involved in field investigations at sites that fall under the EPA Worker Protection requirements of 40 CFR Part 311, referencing OSHA 29 CFR Part 1910.120, and meet the definition of HAZWOPER activities must:

- attend a 40-hour course designed to meet the OSHA health and safety training requirements for hazardous site workers;
- attend an annual 8-hour health and safety refresher course, or receive equivalent

training;

- participate in the DEQ medical monitoring program;
- receive appropriate on-the-job training;
- be familiar with the HSERP, written and maintained by the ESP; and
- be familiar with the ESP SOP manual and have read all SOP documents that are applicable to the field activities, including, but not limited to, those referenced in this SOP.

5.2 All ESP personnel who conduct field or sampling investigations at sites that do not fall under HAZWOPER regulations, must:

- receive appropriate on-the-job training;
- be familiar with the ESP SOP manual and have read all SOP documents that are applicable to the field activities, including but not limited to those referenced in this SOP.

## 6.0 SUPPLIES AND EQUIPMENT

- The Fisher M Scope Model TW5 Metal Detector
- Measuring tape and/or transit for laying out grid patterns
- Non-metallic stakes
- Field Notebook
- Appropriate PPE, as described in the site specific HASP

## 7.0 PROCEDURE

For operation and maintenance procedures, please refer to the manufacturer's operation manual and MDNR-FSS-200 *Equipment Calibration and Preventative Maintenance*. The manufacturer's operation and maintenance instructions should be read prior to using the instrument.

### 7.1 Inductive Mode

In the inductive mode, both the transmitter and receiver are carried by the investigator over areas where metal objects are suspected or the location is unknown. A tone and needle deflection will be produced by the instrument when a metallic object interrupts the current created between the transmitting and receiving coils of the instrument. *Note: Always conduct a battery test on both the transmitter and receiver (see photos #1 and #2) prior to leaving the office.*

7.1.1 For normal inductive mode operation, the transmitter and receiver will be connected using a spacing bar. The transmitter is connected by one screw, while the receiver has two. The screw knob at the top of the receiver has a spring and

serves as a sensitivity adjustment. Set the sensitivity dial on the receiver to the 2 o'clock position and the power dial to low. The auto sensitivity/normal switch should be placed in the normal position. On the transmitter, place the conductive/inductive dial to the inductive position. Pull the on-off switch on both the transmitter and the receiver to the "ON" position. At this point, prior to adjustment, the tone and needle will likely be at the maximum range.

- 7.1.2 As indicated in the manufacturer's operations manual, the sensitivity should be adjusted using the screw knob on the spacing bar (see photo #3). Turn the knob until the spring is compressed, then back the knob off until the tone quiets. Continue backing off the knob until the tone just begins to sound again. The knob should be adjusted until a very faint sound is heard or the needle is just off the zero. The adjustments should be made while in an area where no metallic objects are expected, either above or below the ground surface. Minor changes may have to be made periodically to keep the instrument in adjustment. Condensed operating instructions for inductive surveys are displayed on the receiver and on the transmitter for conductive surveys.
- 7.1.3 The instrument should be held by the bar with one hand placed near the center for balance or with the carrying strap (see photo #4). The operator should walk over the area of concern in a normal upright position while carrying the instrument at his/her side with the arm fully extended toward the ground. It is important that the instrument be held at a consistent distance from the ground since the sensitivity may change at varying distances. The operator should try not to bounce the instrument while walking, as even a slight springing of the bar can cause false readings.
- 7.1.4 If large areas are being surveyed, a pattern of coverage, such as a grid system, should be utilized to assure that the area of concern is completely covered, and that the location of any readings can later be identified. All readings should be noted in a field notebook (see MDNR-FSS-004 *Field Documentation*).
- 7.1.5 Because there is no requirement for the instrument to actually touch the ground it should not come into contact with hazardous substances. However, if the possibility exists, the instrument should be loosely wrapped in clear plastic to prevent the need for decontamination, which may require harsh solvents or detergents (see MDNR-FSS-206 *Decontamination Procedures for Sampling Equipment*).

## 7.2 Conductive Mode

The conductive mode may be used to positively identify the location or trace the route of a pipe or cable by making a direct connection with the transmitter. The transmitter produces a signal through the pipe or cable that can then be detected by the investigator carrying the receiver.

- 7.2.1 In the conductive mode the receiver and transmitter are separated and the inductive/conductive switch on the transmitter is turned to the conductive position.
- 7.2.2 The transmitter is placed in an upright position near a valve or other exposed pipe fitting or cable connection. A ground cable, provided with the instrument, is plugged into the transmitter. A clamp and grounding plate, attached to the opposite end of the cable will be used to ground the transmitter. The clamp is attached to the pipe fitting or cable connection and the grounding plate is inserted into the earth at a right angle position. If earth grounding is not possible, lay the plate on the pavement parallel to the pipe.
- 7.2.3 Sensitivity adjustments in the conductive mode are made by adjusting the sensitivity dial on the receiver (see photo #2) to the right to increase the sensitivity.
- 7.2.4 An accurate location of the pipe or cable can be obtained by passing the receiver over it from both sides and marking where the reading or tone is the highest. The location will be exactly between the two marks.

## 8.0 REFERENCES

- MDNR-FSS-004 *Field Documentation*
- MDNR-FSS-200 *Equipment Calibration and Preventative Maintenance*
- MDNR-FSS-206 *Decontamination Procedures for Sampling Equipment*
- 40 CFR Part 311 referencing 29 CFR §1910-120 “Hazardous Waste Operations and Emergency Response” (HAZWOPER)



Transmitter  
Photo #1



Receiver  
Photo #2



Receiver Attached to Space Bar  
Photo #3



Inductive Mode Operation  
Photo #4